

Claims

- [c1] A method of removing metals from aqueous solutions comprising the steps of:
condensing a mixture of silica solution and mercapatan in alcohol solution by heating the mixture, with a constant removal of water by vapor generated during the heating, wherein a resulting composite is obtained to form an azeotropic mixture; and
removing heavy metal ions from an aqueous solution by distillation.
- [c2] The method of claim 1, wherein the step of condensing is performed by Dean–Stark apparatus.
- [c3] The method of claim1, wherein the step of removing metal ions is performed by evaporation.
- [c4] The method of claim 1, wherein the mercaptan is 2–mercaptoethanol.
- [c5] The method of claim 1, wherein the mercaptan is a coordinating agent.
- [c6] The method of claim 1, wherein the step of condensing is obtained by agitating mixture on a hot plate and then

cooling the mixture.

- [c7] The method of claim 1, wherein the heavy metal ions which are removed, are selected from group consisting of copper, lead and cadmium.
- [c8] The method of claim 1, wherein the step of removing metals, incorporates acetate to shift equilibrium and obtain a greater percentage removal of metal ions.
- [c9] The method of claim 1, wherein the step of condensing, further comprises adding toluene to the mixture.
- [c10] The method of claim 9, wherein the toluene is filtered off and recycled after heating and agitating the mixture.
- [c11] The method of claim 1, wherein the mercaptan in alcohol solution has a greater acidity than the silica gel.
- [c12] A method of azeotropic attachment of mercaptans to silica gel for metal-removing agents comprising the steps of:
heating a mixture of silica gel, a mercaptan in alcohol solution, and toluene, until a constant value is attained for water vapor, obtained by azeotropic distillation, wherein a resulting composite is obtained forming an azeotropic mixture;
condensing the mixture by cooling; and

removing heavy metal ions from an aqueous solution by distillation.

[c13] The method of claim 12, wherein the mixture further comprises sodium sulfate.

[c14] A method of azeotropic attachment of mercaptans to silica gel for metal-removing agents comprising the steps of:

adding silica gel, a mercaptan in alcohol solution, toluene and sodium sulfate to form a mixture;

agitating the mixture on a hot plate, thereby concurrently heating the mixture, until a constant value is attained for water vapor, which is generated during the heating,

condensing the mixture by cooling, wherein a resulting composite is obtained to form an azeotropic mixture; and

removing heavy metal ions from an aqueous solution by azeotropic distillation.

[c15] The method of claim 14, wherein after the step of condensing, the toluene is filtered off and recycled.